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DIRECTORY ORIENTED FTP COMMANDS

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As a part of the Remote Site Maintenance (RSM) project for ARPA, BBN has installed and maintains the software of several DEC PDP-11s running the Unix operating system. Since Unix has a tree-like directory structure, in which directories are as easy to manipulate as ordinary files, we have found it convenient to expand the FTP servers on these machines to include commands which deal with the creation of directories. Since there are other hosts on the ARPA net which have tree-like directories, including Tops-20 and Multics, we have tried to make these commands as general as possible.

We have added four commands to our server:

XMKD child
: Make a directory with the name "child".

XRMD child
: Remove the directory with the name "child".

XPWD
: Print the current working directory.

XCUP
: Change to the parent of the current working directory.

The "child" argument should be created (removed) as a subdirectory of the current working directory, unless the "child" string contains sufficient information to specify otherwise to the server, e.g., "child" is an absolute pathname (in Multics and Unix), or child is something like "<abso.lute.path>" to Tops-20.

REPLY CODES

The XCUP command is a special case of XCWD, and is included to simplify the implementation of programs for transferring directory trees between operating systems having different syntaxes for naming the parent directory. Therefore we recommend that the reply codes for XCUP be identical to the reply codes of XCWD.

Similarly, we recommend that the reply codes for XRMD be identical to the reply codes for its file analogue, DELE.

The reply codes for XMKD, however, are a bit more complicated. A freshly created directory will probably be the object of a future XCWD command. Unfortunately, the argument to XMKD may not always be a suitable argument for XCWD. This is the case, for example, when a Tops-20 subdirectory is created by giving just the subdirectory name. That is, with a Tops-20 server FTP, the command sequence

```
XMKD MYDIR
XCWD MYDIR
```

will fail. The new directory may only be referred to by its "absolute" name; e.g., if the XMKD command above were issued while connected to the directory <DFRANKLIN>, the new subdirectory could only be referred to by the name <DFRANKLIN.MYDIR>.

Even on Unix and Multics, however, the argument given to XMKD may not be suitable. If it is a "relative" pathname (that is, a pathname which is interpreted relative to the current directory), the user would need to be in the same current directory in order to reach the subdirectory. Depending on the application, this may be inconvenient. It is not very robust in any case.

To solve these problems, upon successful completion of an XMKD command, the server should return a line of the form:

257<space>"<directory-name>"<space><commentary>

That is, the server will tell the user what string to use when referring to the created directory. The directory name can contain any character; embedded double-quotes should be escaped

by double-quotes (the "quote-doubling" convention).

For example, a user connects to the directory /usr/dm, and creates a subdirectory, named child:

```
XCWD /usr/dm
200 directory changed to /usr/dm
XMKD child
257 "/usr/dm/child" directory created
```

An example with an embedded double quote:

```
XMKD foo"bar
257 "/usr/dm/foo""bar" directory created
XCWD /usr/dm/foo"bar
200 directory changed to /usr/dm/foo"bar
```

We feel that the prior existence of a subdirectory with the same name should be interpreted as an error, and have implemented our server to give an "access denied" error reply in that case.

```
CWD /usr/dm
200 directory changed to /usr/dm
XMKD child
521-"/usr/dm/child" directory already exists;
521    taking no action.
```

We recommend that failure replies for XMKD be analogous to its file creating cousin, STOR. Also, we recommend that an "access denied" return be given if a file name with the same name as the subdirectory will conflict with the creation of the subdirectory (this is a problem on Unix, but shouldn't be one on Tops-20).

Essentially because the XPWD command returns the same type of information as the successful XMKD command, we have implemented the successful XPWD command to use the 257 reply code as well.

We present here a summary of the proposed reply codes for the experimental commands. The codes given outside parentheses are consistent with RFC 691; i.e., are for the old protocol, as updated by the suggestions in that RFC. The server and user programs at BBN-Unix currently implement these codes. Reply 257 is the only new code. Reply codes shown within parentheses are for the "new" ftp protocol, most recently documented in RFC 765.

The invented code for the RFC 765 Protocol is 251.

Command:

reply code	explanation
XMKD	create directory
257 (251)	"pathname" created
521 (450)	"pathname" already exists
506 (502)	action not implemented
521 (450)	access denied
550 (501)	bad pathname syntax or ambiguous
425 (451)	random file system error
XCUP	change directory to superior of current one
200 (200)	working directory changed
506 (502)	action not implemented
507 (551)	no superior directory
521 (450)	access denied
425 (451)	random file system error
XRMD	remove directory
224 (250)	deleted ok
506 (502)	action not implemented
521 (450)	access denied
550 (501)	bad pathname syntax or ambiguous
425 (451)	random file system error
XPWD	print current working directory
257 (251)	"pathname"
425 (451)	random file system error
506 (502)	action not implemented

SUBTLETIES

Because these commands will be most useful in transferring subtrees from one machine to another, we must stress the fact that the argument to XMKD is to be interpreted as a sub-directory of the current working directory, unless it contains enough information for the destination host to tell otherwise. A hypothetical example of its use in the Tops-20 world:

```
    XCWD <some.where>
200 Working directory changed
    XMKD overrainbow
    257 "<some.where.overrainbow>" directory created
    XCWD overrainbow
    431 No such directory
    XCWD <some.where.overrainbow>
    200 Working directory changed

    XCWD <some.where>
    200 Working directory changed to <some.where>
    XMKD <unambiguous>
    257 "<unambiguous>" directory created
    XCWD <unambiguous>
```

Note that the first example results in a subdirectory of the connected directory. In contrast, the argument in the second example contains enough information for Tops-20 to tell that the <unambiguous> directory is a top-level directory. Note also that in the first example the user "violated" the protocol by attempting to access the freshly created directory with a name other than the one returned by Tops-20. Problems could have resulted in this case had there been an <overrainbow> directory; this is an ambiguity inherent in some Tops-20 implementations. Similar considerations apply to the XRMD command. The point is this: except where to do so would violate a host's conventions for denoting relative versus absolute pathnames, the host should treat the operands of the XMKD and XRMD commands as subdirectories. The 257 reply to the XMKD command must always contain the absolute pathname of the created directory.

References

File Transfer Protocol (RFC 765), Postel, J., June 1980

CWD Command of FTP (RFC 697), Lieb, J., NIC 32963, 14 July 1975
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File Transfer Protocol (RFC 542), Neigus, N., NIC 17759, 12 July 1977